Paper Number 2004-01-010

THE USE OF SCHEMATIC AIDS TO FACILITATE THE INCIDENT REPORTING OF CRITICAL EVENTS

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Incident reports prove useful to aid in problem identification and diminish the threat of accidents, thus improving safety. Most incident reports however, are generally unstructured, providing little or no guidance to the reporter. Therefore, most reports only contain information about *what* happened, as opposed to *why* an incident happened, making identification of intervention and prevention strategies extremely difficult. To remedy this problem we developed and tested a method for improving reporting of incidents using a schematic mapping tool. This method, coined the Critical Event Recall Tool (CERT) in the aviation realm, and the Medical Event Reporting Tool (MERT) in the medical arena, is described and research supporting it as an instrument for improving the quality of incident reports is provided. Employing such methods as CERT/MERT aids the reporter in understanding and explaining his/her actions. It also allows investigators to comprehend why certain decisions were made during the course of an event, as opposed to just learning the chronology of a reported event. Improved incident reports assist in reducing the likelihood of future accidents by providing enhanced information to focus remedial attention on diminishing the chance of a system failure.

Introduction

The healthcare industry, along with other high risk, safety critical industries, seeks alternatives beyond current practices to improve patient safety and minimize human error. By adapting proven human factors investigative methodologies from the aviation realm, healthcare professionals can learn to specifically identify patient safety risk areas to build intervention programs that assess, trap and mitigate these risk areas. Incident reports are one way facilitate the identification of errors and aid in reducing accidents, thus enhancing safety.

The topic of human error in high-risk safety critical environments has attracted wide media and public attention in the last decades pursuant to studies that have exemplified the magnitude of the problem. Leape, Woods, Hatlie, Kizer, Schroeder & Lundberg (1998) estimate 180,000 people across the United States die each year as a result of iatrogenic (physician induced) injury. Analysis of the cause factors associated with these iatrogenic injuries shows they are principally due to human error, thus feasibly avoidable (DuBois & Brook, 1988; Bedell, Deitz, Leeman & Delbanco, 1991). An estimate of medical error places them among the top ten major causes of death in the healthcare industry as a whole, costing as much as 29 billion dollars annually (Rall et al., 2001; Corrigan, Kohn & Donaldson, 2000). Data suggests that these estimates of human error in the medical realm are low, as only a few specific areas are currently studied (e.g., radiology, anesthesia, medication error), and that the complete range of the effects of human error in medicine may not be evident for quite some time (Wiegmann, Taneja & von Thaden, 2003).

In aviation, human error is estimated as a causal factor in 60 to 80% of accidents (Dismukes, Young & Sumwalt, 1999). Clearly the need to reduce human error in these industries is prevalent and with this in mind, the need for anonymous incident reporting systems proves crucial to understanding the causes of error and preventing accidents (Connell, 1999). To achieve this goal, incident investigation needs to address the primary cause human errors in a system so that solutions and safety efforts can focus on the important human factors issues. One way to achieve this is to improve the data collected from incident reports.

Incident Reporting

Incidents, or deviations from safe operations, serve as precursors to accidents occurring in order of magnitude significantly higher than accidents (Heinrich, 1959). These incidents indicate the presence of troubles in systems that if left unattended have the potential to result in an accident. Based on this, anonymous incident reporting has long been employed in the aviation realm as a proactive tool to study and treat unsafe conditions or actions before they result in an accident (Connell, 1999; Fitts & Jones, 1947).

One extensively known incident reporting system is the Aviation Safety Reporting System (ASRS) administered by the National Aeronautics and Space Administration (NASA) (Chappell, 1997). Recently the U.S. Veteran's Administration developed the Patient Safety Reporting System (PSRS) modeled after NASA'S ASRS, and administered by NASA. These reporting systems consist of voluntary, anonymous incident (safety related event) information submitted by personnel. While there are other incident reporting systems such as the Critical Incident Reporting System (CIRS) (Staender, Davies, Helmreich, Sexton & Kaufmann, 1997), the Medical Event Reporting System (MERS) (Medical Event Reporting System, 2000), in addition to organizationally developed reporting systems, most, if not all, have a section in which the reporter is asked to describe the incident in narrative form. Commonly, this description provided by the reporter is used as the key element in discerning the factors

that contributed to the event (Wiegmann, & von Thaden, 2003).

Lamentably, many incident reporting systems do not gather rich enough event information to provide a full explanation of why an unsafe act has occurred, yet they are many times the only reporting tools available. One-on-one interviews prove too costly and time consuming, and given the high number of incidents that occur, infeasible. Due to this, information is generally gathered using incident disclosure forms that are hand written by the reporter. The forms used to report safety events often collect a plethora of pre-determined factual information surrounding the incident, (e.g., setting, time of day, environmental factors) but provide little to no guidance to the reporter on how to describe the critical events that unfolded during the incident, in the free-format portion of the report (von Thaden & Wiegmann, 2001). Resultant of this, most reports contain only information as to *what* happened, rather than *why* and incident occurred. In addition to this, incident reports infrequently provide information regarding the conditions surrounding the incident that kept it from becoming an accident. As a result of the often-scant information included in the narrative portion of incident reports, discovering strategies for accident prevention from these reports can be a daunting task (Wiegmann & von Thaden, 2001).

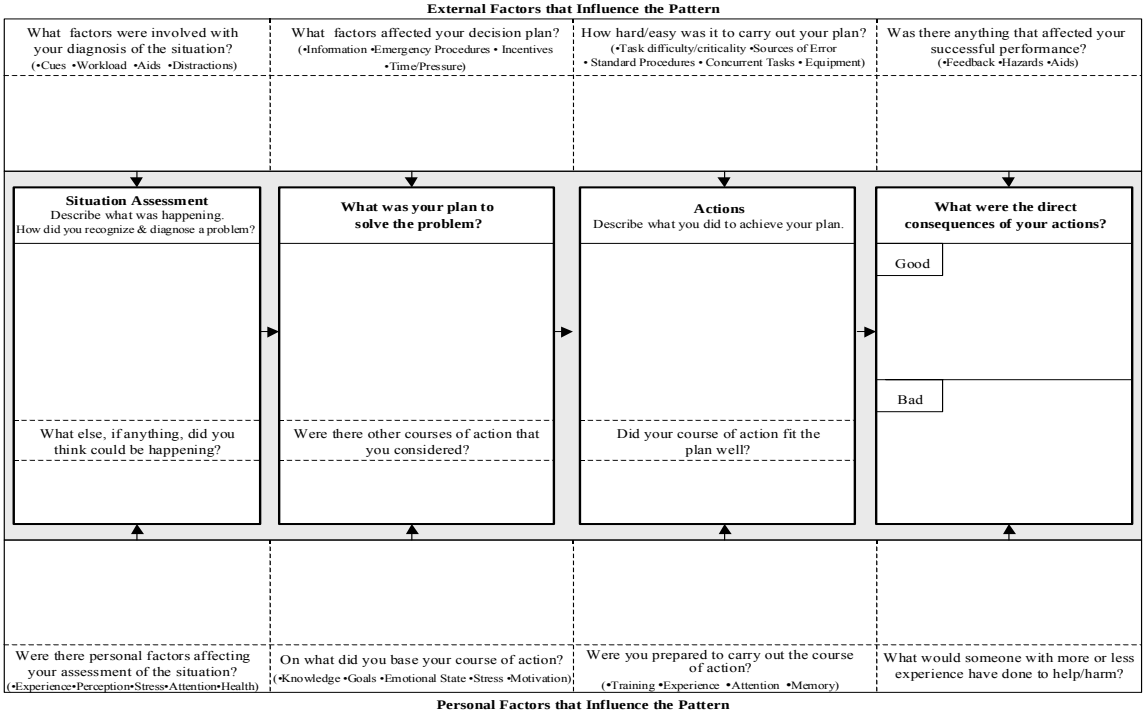

Figure 1. The Critical Event/Medical Event Reporting Tool.

The Critical/Medical Event Reporting Tool

We developed a schematic reporting tool to aid in producing a narrative report that contained useful information regarding the events leading up to the incident in question. This tool, dubbed the Critical Event Reporting Tool (CERT), and later the Medical Event Reporting Tool (MERT), consists of a schematic map employing the principles of Cognitive Task Analysis and the Critical Decision Method (Klein, Calderwood & MacGregor, 1989; Militello & Hutton, 1998) in addition to research on schematic mapping (Wiegmann, Dansereau, Skaggs & Gordon, 1992) (see Figure 1). This tool was developed to serve specifically as a knowledge elicitation tool for recalling event-related information prior to writing a narrative essay. CERT encourages the reporter to consider precisely *why* an incident occurred along with the factors that affected their actions during the incident, in addition to describing *what* events occurred (Wiegmann & von Thaden, 2001). We developed the tool to prompt recall of events and provide a structure for cueing the recall of important event information. The layout of the form was developed to highlight interrelationships among the factors of the incident, and provide feedback to the reporter where there may be gaps in their recollection or description of the events.

CERT was empirically evaluated for its effectiveness as a pre-organizer to event reporting. A group of general aviation pilots (n=34) who were exposed to

identical failures on a simulated cross-country flight and asked to fill out incident reporting forms. Half of the pilots (CERT group, *n*=17) used the event reporting tool in addition to the normal ASRS type-reporting form, while the other half (Control group, *n*=17) received only the ASRS type reporting form (see Wiegmann & von Thaden, 2003, for a full account of the research). Participants rated CERT positively, noting it aided recall, proved helpful in highlighting areas where information may have been left out, flexible enough to adapt to specific needs, and not too technical to understand.

Independent raters blind to group assignment evaluated the narrative essays. Among other criteria, the content of the essays was analyzed by categorizing the statements into one of three categories: *what* happened (i.e., descriptive statements about the events), *why* something happened (i.e., analytical statements about the events), and *context* statements (i.e. preamble and postscript statements). Figure 2 shows the percentage of statements within the essays as they were allocated within the categories. As can be seen from the figure, the majority of essay statements were descriptive in nature. The control group (essay only) averaged only slightly higher (*M* = 69%) descriptive statements than did the CERT group (*M* = 68%), thus demonstrating no discernable difference in the amount of descriptive statements between the groups. The control group also demonstrated a higher percentage of context statements (*M* =18%) than the CERT group (*M* = 13%). Notably though, the essays by participants in the CERT group contained a higher percentage of analytical statements (*M* = 19%) than the control group (*M* = 13%).

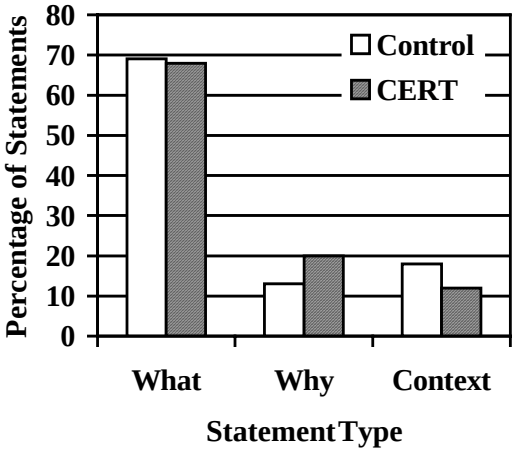

Figure 2. Essay content of CERT and control groups.

Present Research

The focus of the present study is to provide additional analysis of the narrative data contained in the reports for content fidelity. Our aim is to determine if the nature of the reported information provides diagnostic elements and causal explanations aiding in incident analysis. Bear in mind that all participants were given the same reporting form to fill out with instructions to discuss that which they felt relevant and anything else important in recapitulating the incident events. They were asked to include what they believed caused the problem, and what could have been done to prevent a recurrence, or correct the situation. Consistent with NASA's ASRS form, each form had a reference guide at the bottom listing factors for consideration, consisting of:

Chain of Events

- How problem arose
- How it was discovered
- Contributing factors
- Corrective actions

Human Performance Considerations

- Perceptions, judgments, decisions
- Actions or inactions
- Factors affecting the quality of human performance

Results

Thirty-four original incident reports from our previous study were analyzed for content without regard for their grouping category (17=CERT group, 17=control group). Four of these reports were determined to contain no diagnostic information at all. Of these 4 narratives, all (24%) were determined to belong to the control (essay only) group.

Further comparison of the narrative descriptions between the control (essay only) and CERT groups revealed participants from the CERT group provided more information about their decision process and the factors that shaped their decision (Figure 3). This is particularly evident upon analyzing the content of the reports for diagnostic statements.

While both groups received the same narrative reporting form, the CERT group, which had used the organizational mapping tool to recall important event information prior to writing the essay, produced essays with more analytical information describing the motivating factors behind their decisions and what they might have done differently. Of note is the significantly higher amount of statements (over 50%) by the CERT group of internal or personal factors that affected their decision-making.

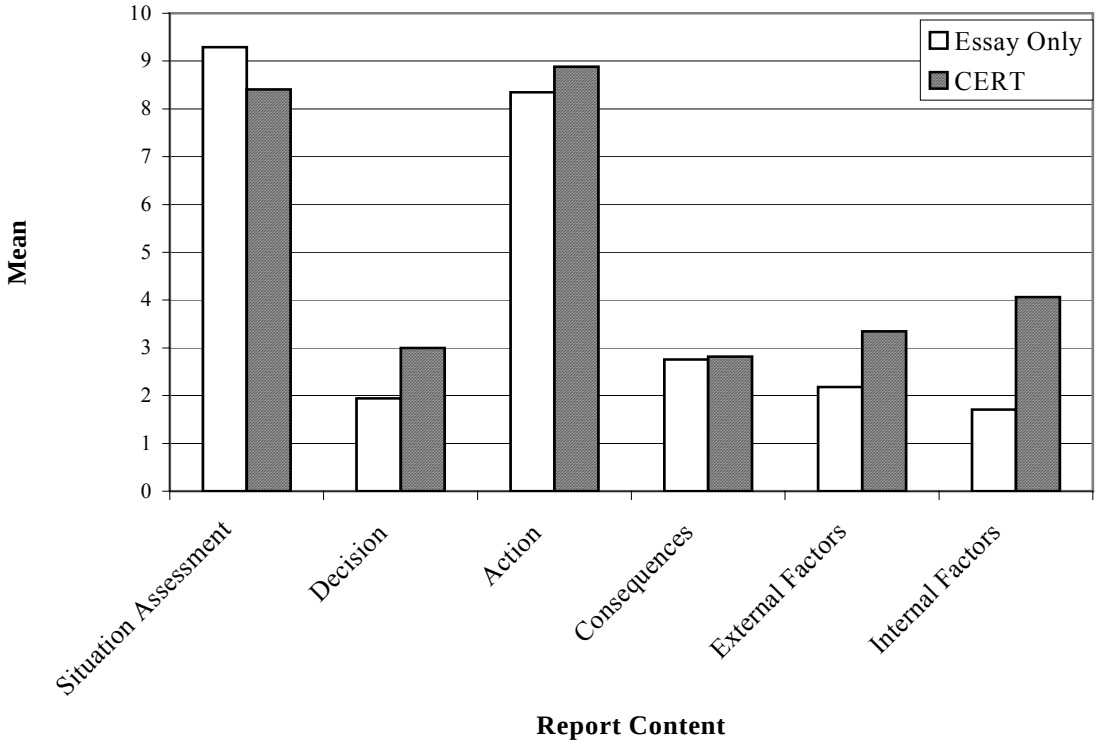

Figure 3. Comparison of statement content between Essay-only and Reporting Tool groups.

Discussion

It appears the use of the mapping tool aids the reporter in effectively and systematically reporting the key elements in the sequence of events leading up to an adverse event as opposed to those who have no mapping tool. Specifically the CERT/MERT allows for the extraction of additional details, including motivational factors, in incident reporting. By supplementing the traditional reporting process with a pre-organizational mapping tool such as CERT/MERT, the need for additional expert human factors investigative personnel is reduced. The improved analytical content of the reports reduce the task of the investigator, making identification of intervention and prevention strategies easier.

Utilizing such methods as CERT/MERT aids the reporter in understanding the motivation behind actions to better explain their decisions. It also allows investigators to comprehend why certain decisions were made during the course of an event, as opposed to just learning the chronology of a reported event. Improved incident reports assist in reducing the likelihood of future accidents by providing enhanced information to focus remedial attention on diminishing the chance of a system accident.

The generic structure of form allows for adequate information representation across domains. It provides structure for improved information recall without proving too rigid or confusing in nature, yet not so generic that it does not fit the event experience. With its theoretical basis and its generic structure the CERT/MERT has great potential to be employed as an event reporting aid in the various operational environments of medicine, negating the need for the individual incident forms each discipline within the healthcare industry currently employs.

Acknowledgments

This material is based upon work supported by the Federal Aviation Administration under Award No. DTFA 99-G-006. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Federal Aviation Administration.

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